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Fast Radial Basis Functions in Digital Engineering Applications

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Radial Basis Functions (RBFs), since their inception in the 1960s, have emerged as a key tool for digital engineering applications. As interpolators in multi-dimensional spaces, RBFs play a crucial role both in generic data science problems and in 3D space manipulation. Their ability to represent large 3D datasets in a mesh-free manner has established them as the standard approach for data mapping and mesh deformation. A fast implementation of RBFs is essential to fully exploit this mathematical approach in digital engineering applications. This paper provides an overview of fast RBF methods in digital engineering and presents a practical application in the field of Computer-Aided Engineering (CAE), highlighting the role of RBFs in the development of a digital twin capable of real-time interaction with a 3D structural component.

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